PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference PA133321/PCT	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/IB2005/000045	International filing date *(day/month/year)* 12.01.2005	Priority date *(day/month/year)* 16.01.2004
International Patent Classification (IPC) or national classification and IPC INV. B23K15/00 B23K1/005 C04B37/02		
Applicant ELEMENT SIX LIMITED		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 4 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☒	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
15.11.2005	28.04.2006
Name and mailing address of the international preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized officer Raming, T Telephone No. +31 70 340-4232

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IB2005/000045

Box No. I Basis of the report

1. With regard to the **language**, this report is based on

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3(a) and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4(a))
   - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

   Description, Pages

   1-9 as originally filed

   Claims, Numbers

   1-20 filed with telefax on 09.12.2005

   ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-20
	No:	Claims	
Inventive step (IS)	Yes:	Claims	3
	No:	Claims	1,2,4-20
Industrial applicability (IA)	Yes:	Claims	1-20
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Reference is made to the following documents:

D1: PATENT ABSTRACTS OF JAPAN vol. 012, no. 061 (M-671), 24 February 1988 (1988-02-24) & JP 62 207590 A (ASAHI DAIYAMONDO KOGYO KK; others: 01), 11 September 1987 (1987-09-11)

D2: PATENT ABSTRACTS OF JAPAN vol. 011, no. 302 (M-629), 2 October 1987 (1987-10-02) & JP 62 094211 A (SUMITOMO ELECTRIC IND LTD), 30 April 1987 (1987-04-30)

D3: US-A-3 437 785 (DAVID SCIAKY) 8 April 1969 (1969-04-08)

Re Item I

Basis of the report

1. Amendments (Article 34(2) PCT)

The amendments do not seem to introduce subject-matter which extends beyond the content of the application as filed, contrary to Article 34(2)(b) PCT.

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

2. Novelty (Article 33(2) PCT)

It seems the applicant assumes that the polycrystalline diamond element of document D1 is not phase-pure. Although PCD usually indeed does not consist purely out of diamond, but also contains a binder phase, it can not just be assumed that this is also the case with the PCD from document D1. There is also phase-pure PCD, like polycrystalline CVD diamond. Document D1 does not disclose, however, at least not in the abstract, any of the diamond forms mentioned in claim 1 of the application. Therefore the application seems novel in comparison with the cited prior art.

3. Inventivity (Article 33(3) PCT)

The applicant has made clear that it is essential to the invention that the metal used is a carbide-former. Since independent claims 1, 12 and 13 do not contain this feature, they do not meet the requirement following from Article 6 PCT taken in combination with Rule 6.3(b) PCT that any independent claim must contain all the technical features essential to the definition of the invention.

It is acknowledged that not all metals easily form a carbide, although technically even a metal like nickel can from a carbide. This will normally not happen though. The cited prior art does not suggest the joining of a carbide forming metal with phase-pure diamond elements through electron beam heating. Claim 3 therefore is inventive.

Claims 1, 2 and 4-20 are not connected with an inventive step, since they lack the aforementioned essential feature.

Re Item VIII
Certain observations on the international application

4. Clarity and support (Article 6 PCT)
Although claims 1, 12 and 13 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought. The aforementioned claims therefore lack conciseness and as such do not meet the requirements of Article 6 PCT.

CLAIMS

1. A method of producing a bonded assembly comprising a diamond element, the method including the steps of providing a diamond element selected from polycrystalline CVD diamond, single crystal CVD diamond, natural single crystal diamond, and single crystal diamond2 synthesised by high temperature/high pressure techniques, and at least one other structural element for the assembly, contacting at least one surface on the diamond element with at least one surface on the structural element, and applying electron beam heating to a localised region of the contacting surfaces to cause bonding of at least a portion of the contacting surfaces in that region.

2. A method according to claim 1, wherein the structural element is formed of a material that is capable of forming a diffusion or diffusion-type bond with the diamond element.

3. A method according to claim 2, wherein the structural element is formed of a carbide forming material.

4. A method according to claim 3, wherein the structural element is formed of titanium or molybdenum.

5. A method according to claim 1, wherein a surface of the diamond element is coated or otherwise provided with a layer of a material that is capable of forming a diffusion or diffusion-type bond with the diamond element, the coated surface of the diamond element being brought into contact with the structural element prior to the localised application of electron beam heating to cause bonding of at least a portion of the contacting surfaces.

6. A method according to claim 5, wherein the structural element is formed of a ferrous metal, a non-ferrous metal, or an alloy of either such metal.

7. A method according to claim 6, wherein the structural element is formed of copper, aluminium or steel.

8. A method according to any one of claims 5 to 7, wherein the coating layer is formed of a carbide forming material.

9. A method according to claim 8, wherein the coating layer is formed of titanium or molybdenum.

10. A method according to any one of the preceding claims, wherein the electron beam heating is carried out under conditions in which the temperature of the surface of the structural element bonding to the diamond does not exceed its melting point.

11. A method according to claim 10, wherein the temperature of the surface of the structural element bonding to the diamond does not exceed 80% of its melting point.

12. A method of producing a bonded assembly comprising a diamond element, the method including the steps of providing a diamond element selected from polycrystalline CVD diamond, single crystal CVD diamond, natural single crystal diamond, and single crystal diamond synthesised by high temperature/high pressure techniques, and at least one other structural element for the assembly, which structural element is formed of material that is capable of forming a diffusion or diffusion-type bond with diamond, contacting at least one surface on the diamond element with at least one surface on the structural element and applying electron beam heating to a localised region of the contacting surfaces to cause

bonding of at least a portion of the contacting surfaces in that region.

13. A method of producing a bonded assembly comprising a diamond element, the method including the steps of providing a diamond element selected from polycrystalline CVD diamond, single crystal CVD diamond, natural single crystal diamond, and single crystal diamond synthesised by high temperature/high pressure techniques, and at least one other structural element for the assembly, coating at least one surface of the diamond element with a material that is capable of forming a diffusion or diffusion-type bond with diamond, contacting the at least one coated surface of the diamond element with at least one surface of the structural element, and applying electron beam heating to a localised region of the contacting surfaces to cause bonding of at least a portion of the contacting surfaces in that region.

14. A method according to claim 12 or claim 13, wherein the electron beam heating is carried out under conditions in which the temperature of the surface of the structural element bonding to the diamond does not exceed its melting point.

15. A method according to claim 14, wherein the temperature of the surface of the structural element bonding to the diamond does not exceed 80% of its melting point.

16. A method according to any one of the preceding claims, wherein the diamond element is a layer of diamond.

17. A method according to any one of the preceding claims, wherein the structural element is a frame or mount.

18. A method according to any one of the preceding claims, wherein the electron beam heating takes place in a vacuum.

19. A method according to any one of the preceding claims, wherein the electron beam heating takes place at currents in the range of 0.01A – 10A and voltages in the range of 1 kV – 100 kV.

20. A method according to any one of the preceding claims, wherein the diamond element is polycrystalline or single crystal CVD diamond.